Explaining Systematic Bias and Nontransparency in US Social Security Administration Forecasts

Konstantin Kashin, Gary King, Samir Soneji[1]

Institute for Quantitative Social Science
Harvard University

(Talk at the Social Security Technical Advisory Panel, Washington D.C., 5/7/2015)

[1] KonstantinKashin.com, GaryKing.org, j.mp/soneji

References (all forthcoming)

- Systematic Bias and Nontransparency in US Social Security Administration Forecasts
  Journal of Economic Perspectives
- Explaining Systematic Bias and Nontransparency in US Social Security Administration Forecasts
  Political Analysis
- Online Appendix: Systematic Bias and Nontransparency in US Social Security Administration Forecasts
  Journal of Economic Perspectives
- Replication Data for: Systematic Bias and Nontransparency in US Social Security Administration Forecasts
  Journal of Economic Perspectives Archive, and *Dataverse*
- Replication Data for: Explaining Systematic Bias and Nontransparency in US Social Security Administration Forecasts
  The Political Analysis Dataverse
- (Results and data shared with SSA Technical Panel: 11/2014)

The Essential Role of Forecasting in the US Government

- Social Security
  - Single largest U.S. government program
  - 37% of federal outlays ($1.3T in 2013 expenditures)
  - Brings 20% of elderly Americans above poverty level
  - Enormously popular
  - Proposals for change: highly controversial, partisan, cross-cutting, and personal — the "third rail of American politics"
  - Payroll taxes $\rightsquigarrow$ Trust Funds (now $\approx$\$2.8T) $\rightsquigarrow$ beneficiaries
  - SSA demographic and financial forecasts:
    - under factual conditions, used to evaluate solvency
    - under counterfactual conditions, used to score policy proposals
- Other Programs that Rely on SSA Forecasts
  - Medicare & Medicaid Trust Funds; CBO evaluations, etc.
  - $\rightsquigarrow$ Programs comprising $\underline{> 50\%}$ of US government expenditures

Nontransparency in Forecasting

- Who forecasts independently of SSA's Office of the Chief Actuary?
  - No one
- Who has been able to fully replicate OCACT's forecasts?
  - No one
  - Some data shared: in difficult, disorganized, non-automated formats
  - Some impossible to share: informal, qualitative methods; e.g., committees choosing huge numbers of adjustable parameters
  - Much could be shared but is not (with the public, the scientific community, US government agencies, or even other parts of SSA)
- Nontransparency and lack of data sharing violates:
  - repeated, emphatic calls from SSA's Technical Advisory Panels
  - Executive Orders requiring "a presumption in favor of openness," data that's "accessible, discoverable, and usable by the public"
  - the data sharing revolution in academia
- The standard is not whether OCACT thinks they've shared enough; it's whether they have made it easy enough for others to contribute
- Enormous missed opportunity: for the scientific community and others to check and improve SSA forecasts (for free); but easy to fix!

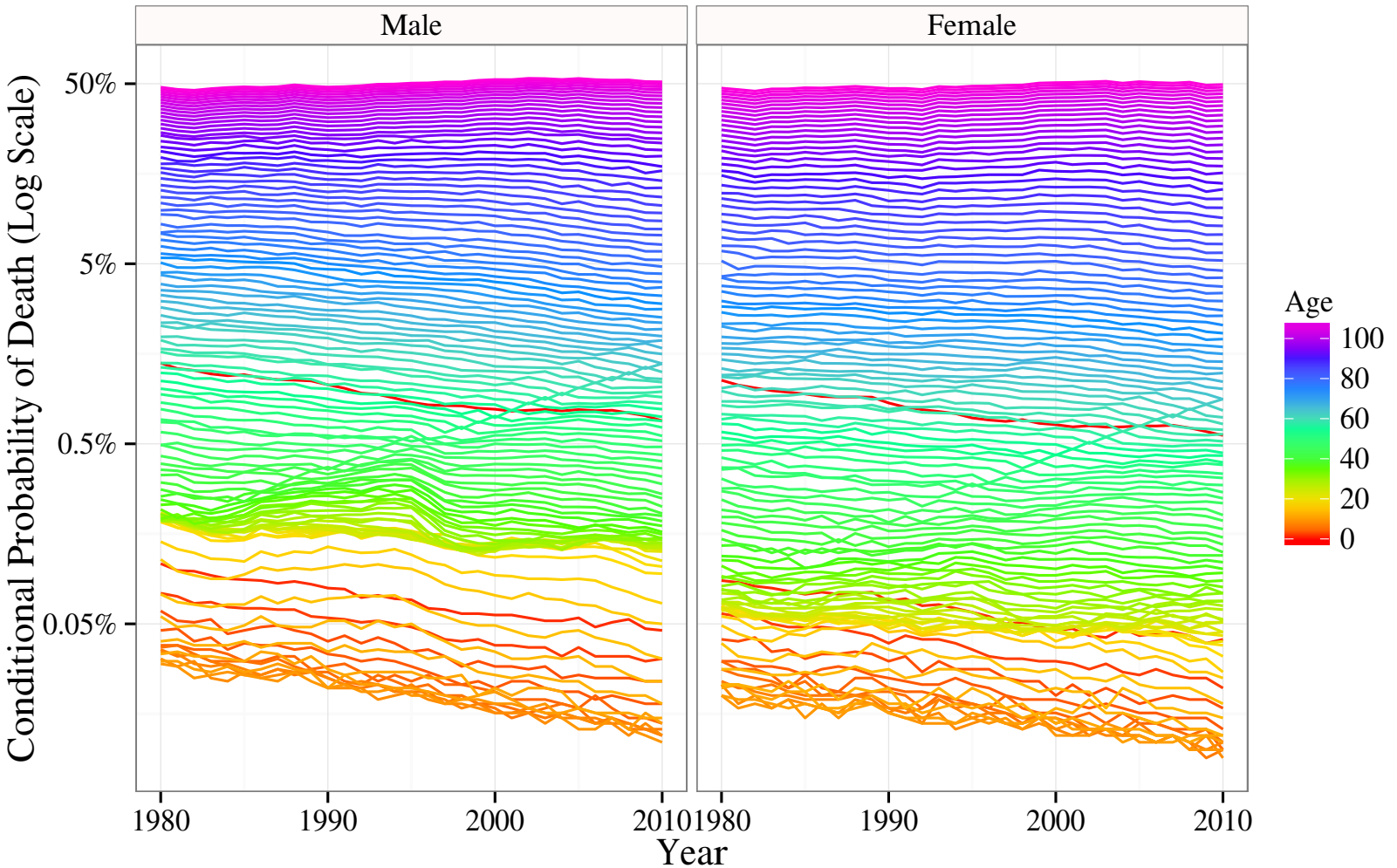
Evaluating SSA Forecasts

- The history of all systematic evaluations of SSA forecasts:
  - by SSA: None
  - by others: None
  - (A few highly selected numbers discussed in speeches)
- Great opportunity for science and policy:
  - SSA has been forecasting for so long, we can make truly out-of-sample evaluations, & use errors to improve
  - Our methods:
    - Systematically compared each SSA forecast to the truth
    - Conducted large number of detailed, semi-structured interviews with participants at every level of the policy and forecasting process
- Preview of Results:
  - Before c. 2000: Approximately unbiased forecasts
  - After 2000: Systematically biased forecasts, increasingly so over time, all in the same direction — making the Trust Funds consistently appear healthier than they actually are
  - How big is the bias? Larger than almost all of OCACT's policy scores
    $\rightsquigarrow$ Policy scores: mostly indistinguishable from random noise
  - Straightforward solutions exist for all problems discovered

How OCACT Forecasts

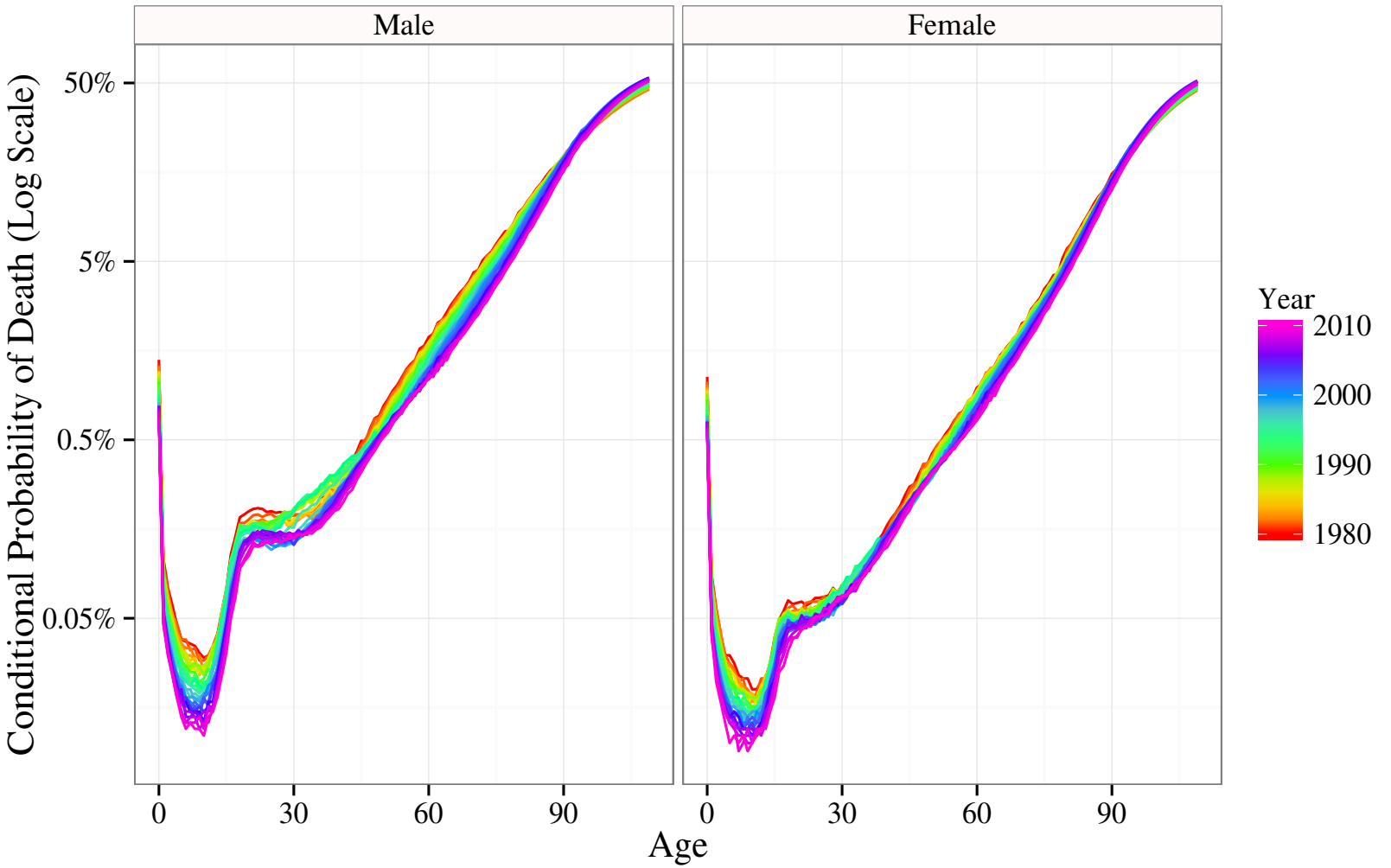
- SSA methods: Jerry rigged, suboptimal, ad hoc, not replicable, and little changed in decades — a period with breathtaking advances in big data, data science, statistics, and social psychology
- Example: Mortality Forecasts
  - Estimate 294 "historical rates of decline" (21 ages $\times$ 2 sexes $\times$ 7 causes) by independent linear regressions on time, ignoring known risk factors, like smoking & obesity
  - Choose 210 "ultimate annual rates of mortality decline" (5 age groups $\times$ 2 sexes $\times$ 3 cost scenarios $\times$ 7 (or 5) causes) for year $t + 26$ by committee in private
  - Define future "annual rates of mortality decline" for each of the 294 groups, assuming constancy within each age group:
    - $t + 1$ to $t + 2$: "historical" rate; or 0.75$\times$"historical" if negative
    - $t + 3$ to $t + 25$: change linearly from "historical" to "ultimate"
    - $t + 26$ to $t + 75$: "ultimate" rate assumed constant for 50 years
  - Iteratively multiply 210 (or 150) mortality rates by the future annual rates; sum across (7 or 5) causes (within age-sex-cost groups)
  - A committee in private evaluates forecasts, adjusts "ultimate" rates, and repeatedly reruns algorithm until consistent with their views

Actual Mortality Time Profiles are Complex



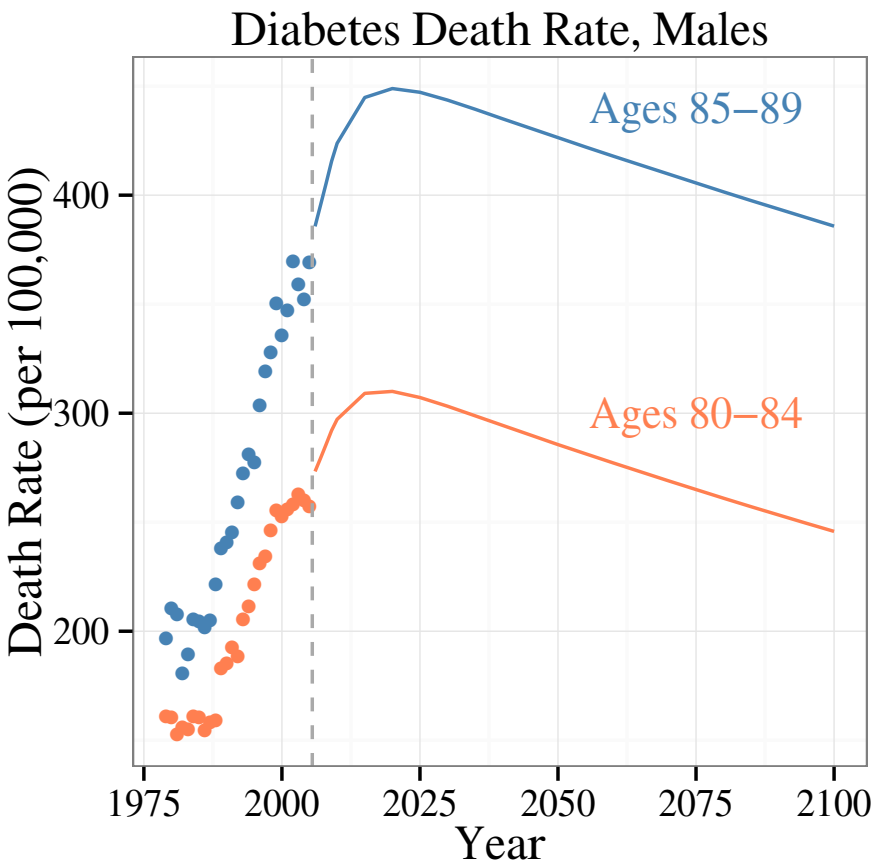
Patterns: $\approx$ linear, different slopes, different variances, diagonal ripples

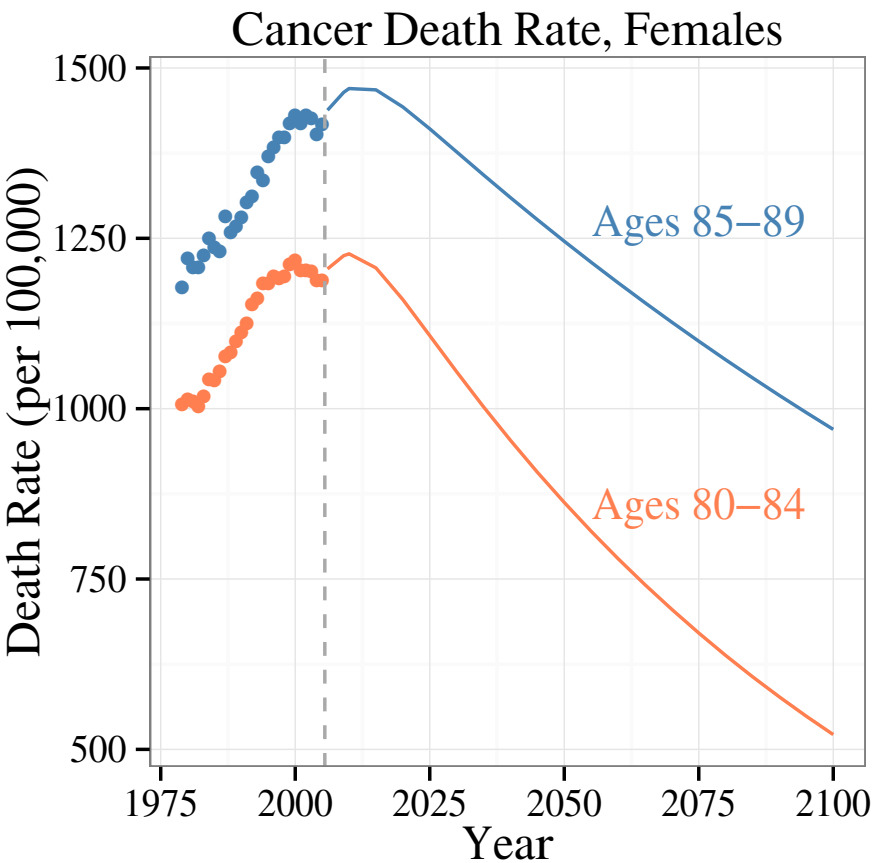
Actual Mortality Age Profiles are also Complex



Patterns: Characteristic shape, partly linear, different time×age trends

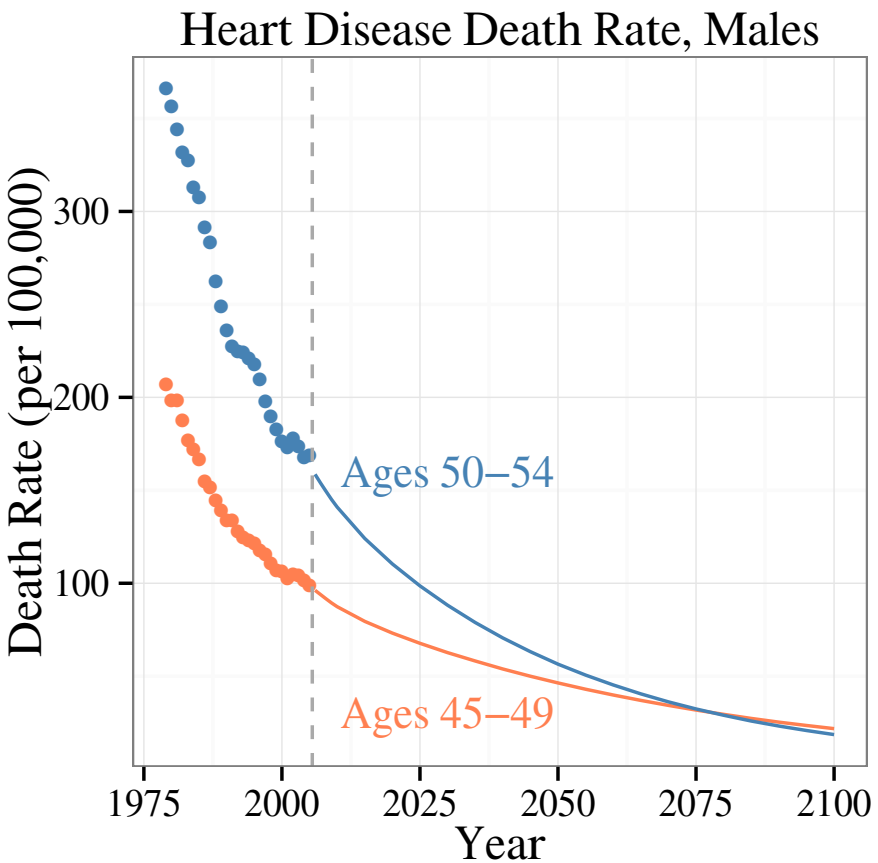
OCACT Qualitative Choices: Violate Known Information

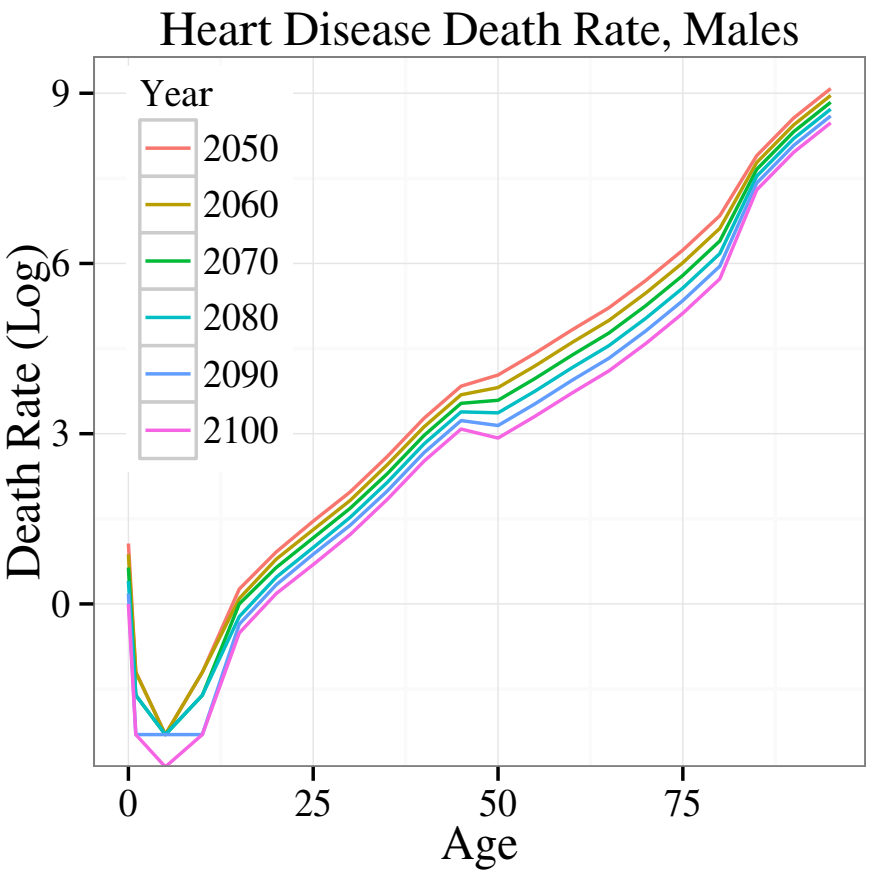




Unrealistic patterns: change of directions, change of differences

OCACT Qualitative Choices: Violate Known Information

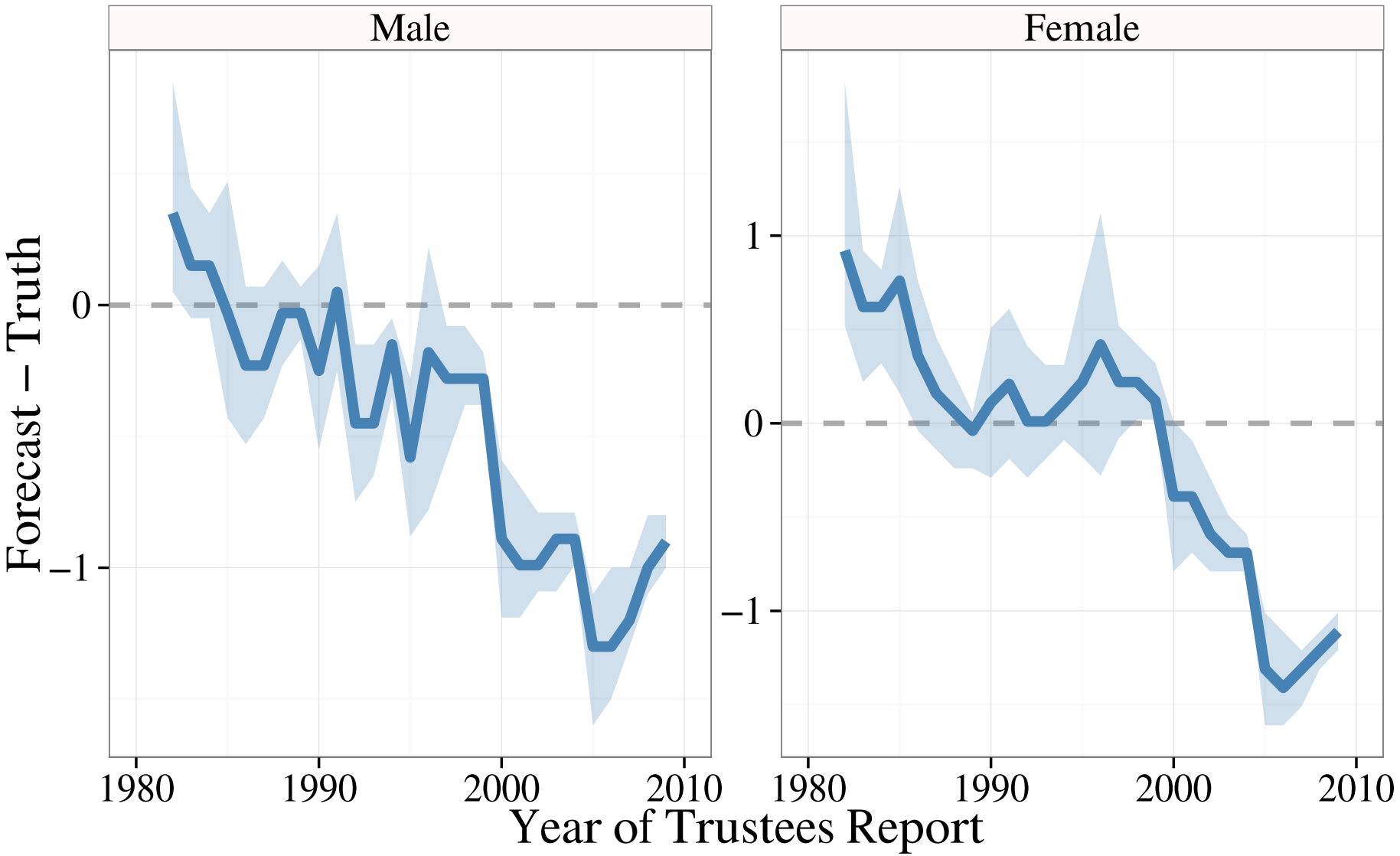




Unrealistic patterns: Crossing age plots, notch for 50-75 year olds

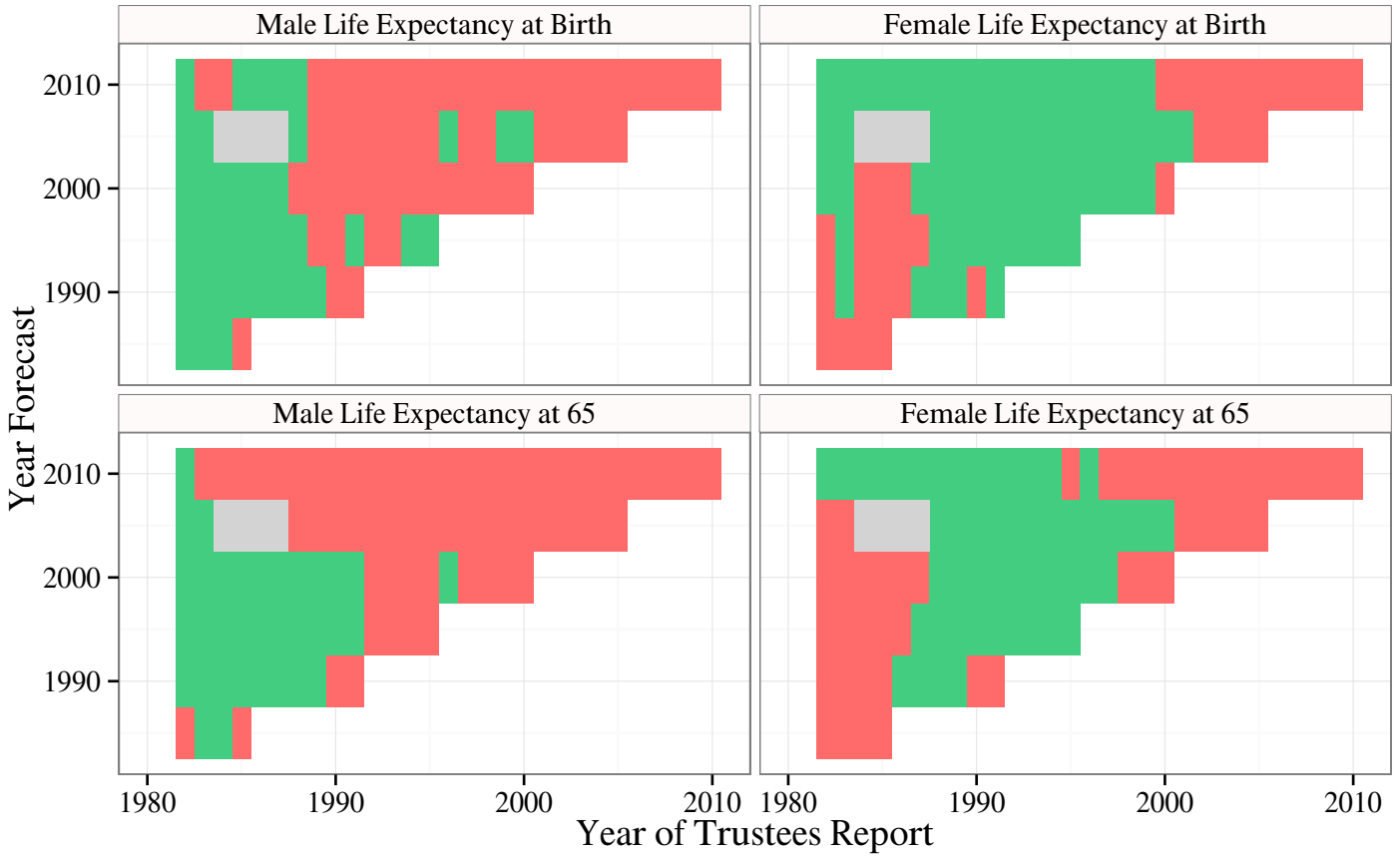
SSA Life Expectancy Forecasts: Increasing Bias Since 2000

(LE at 65; 1-5 year SSA forecasts)



Life Expectancy "Uncertainty Interval" Coverage

Systematic overconfidence since at least 2000

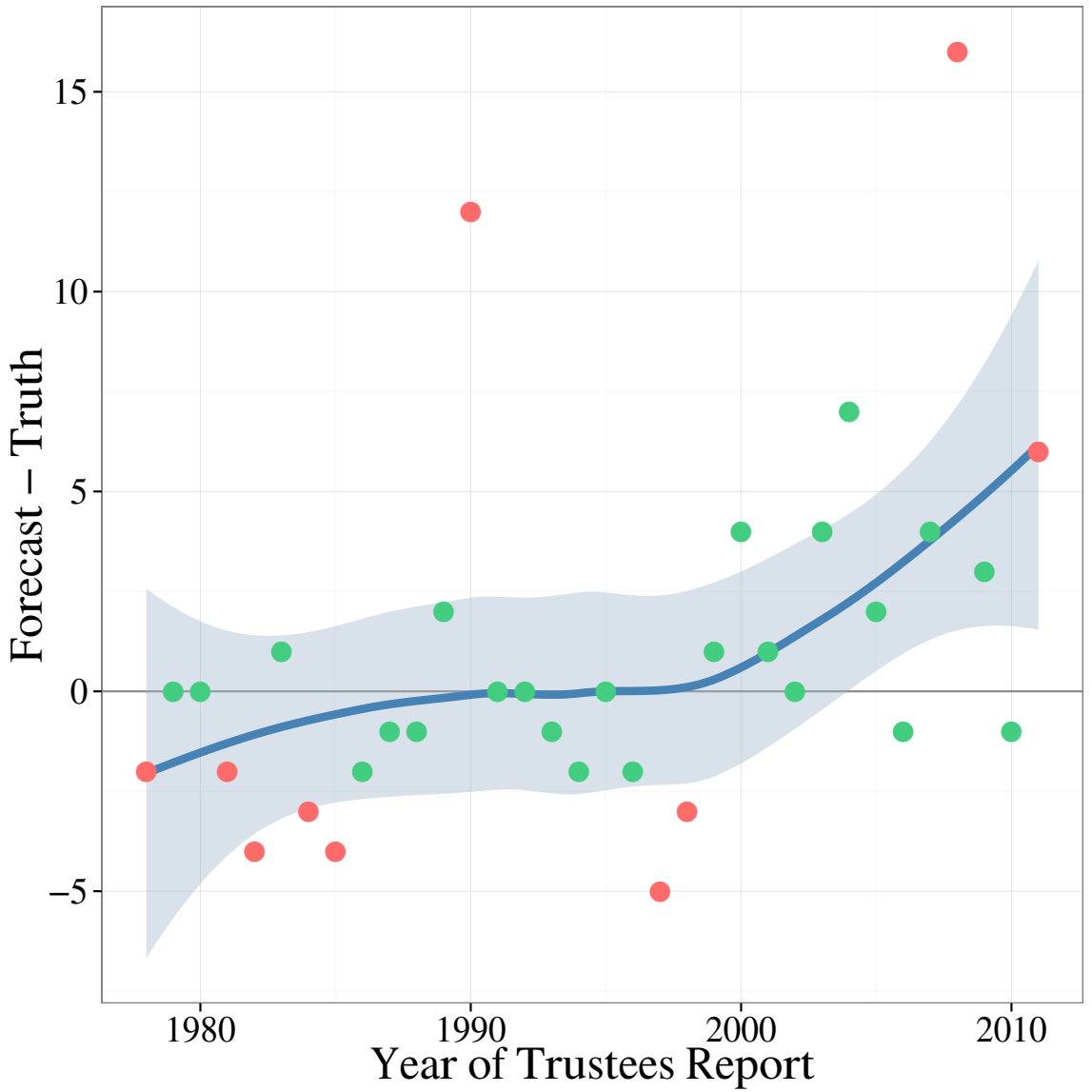


Patterns:

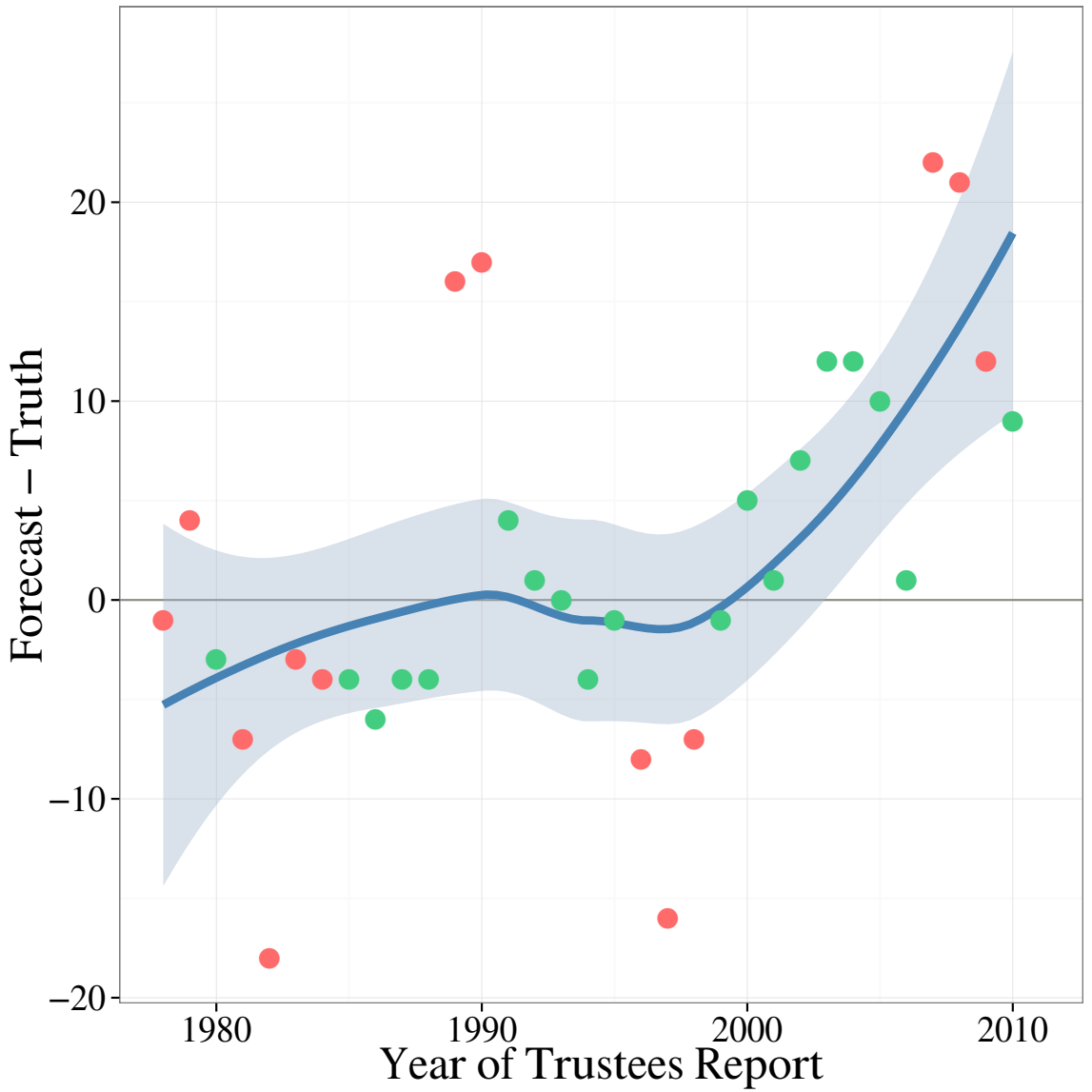
- Vertical: Later Trustees Reports are overconfident
- Not horizontal: Shorter term forecasts should be better, but aren't

Trust Fund Ratio Forecasting Errors

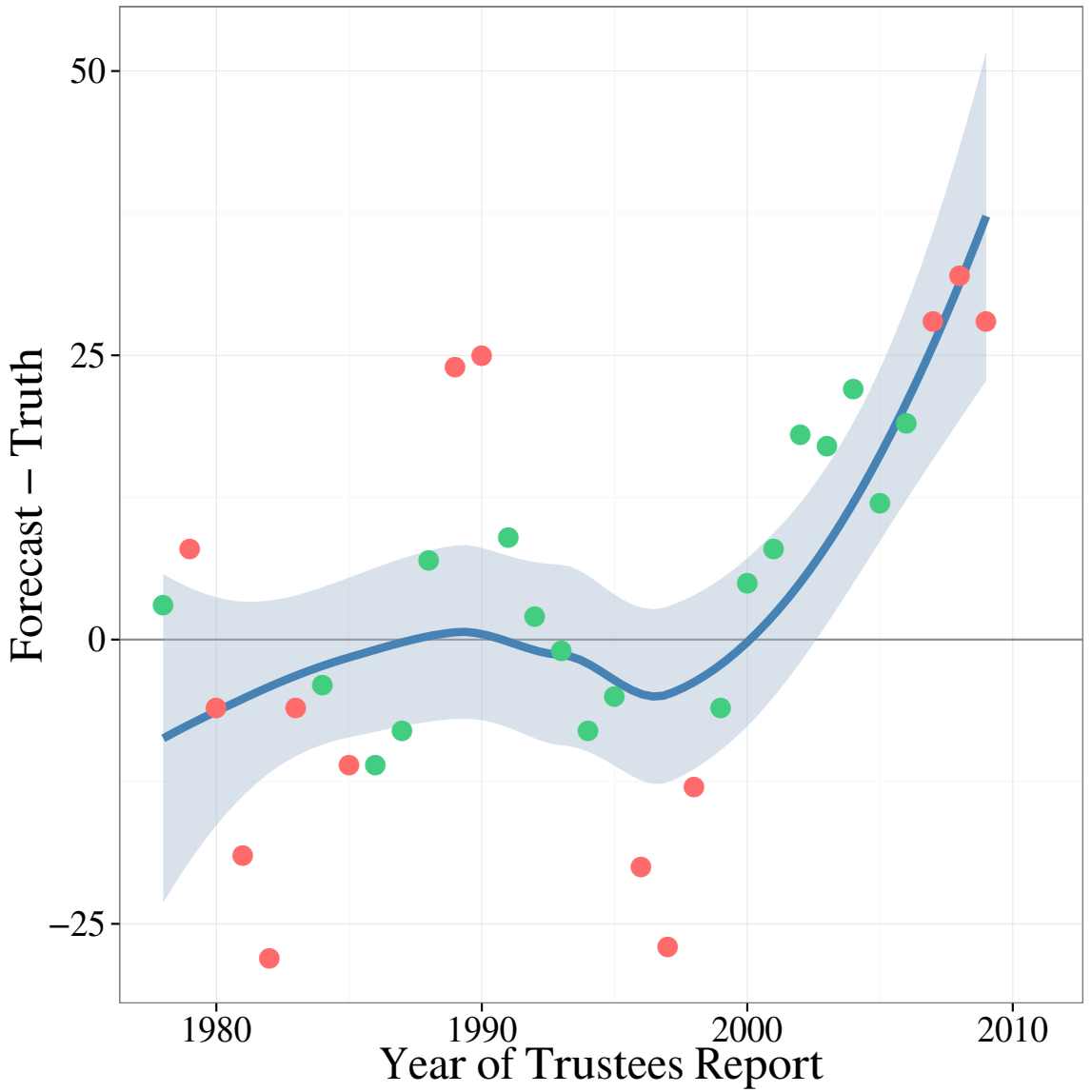
Trust Fund Ratio Forecasting Errors: 1 Year Ahead



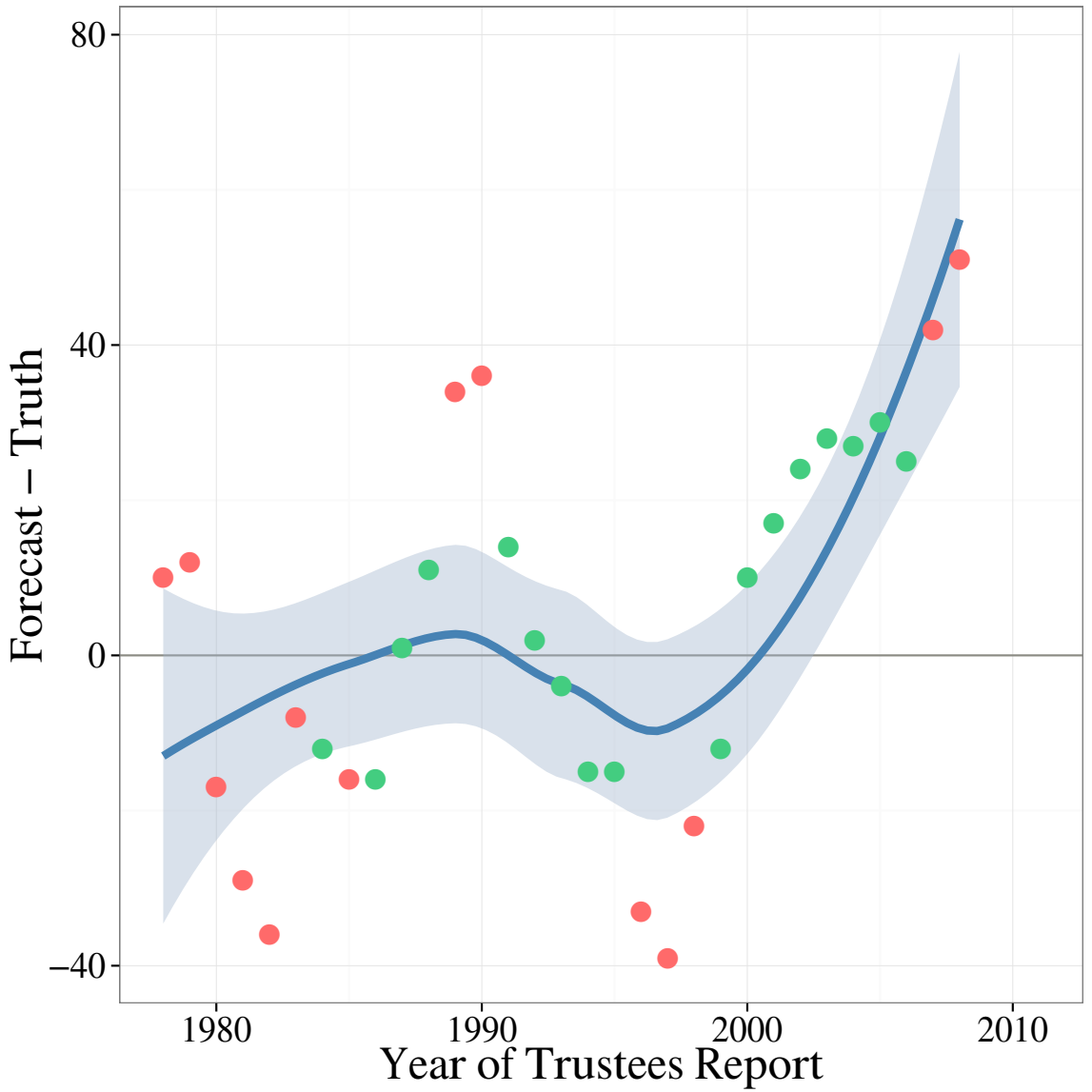
Trust Fund Ratio Forecasting Errors: 2 Years Ahead



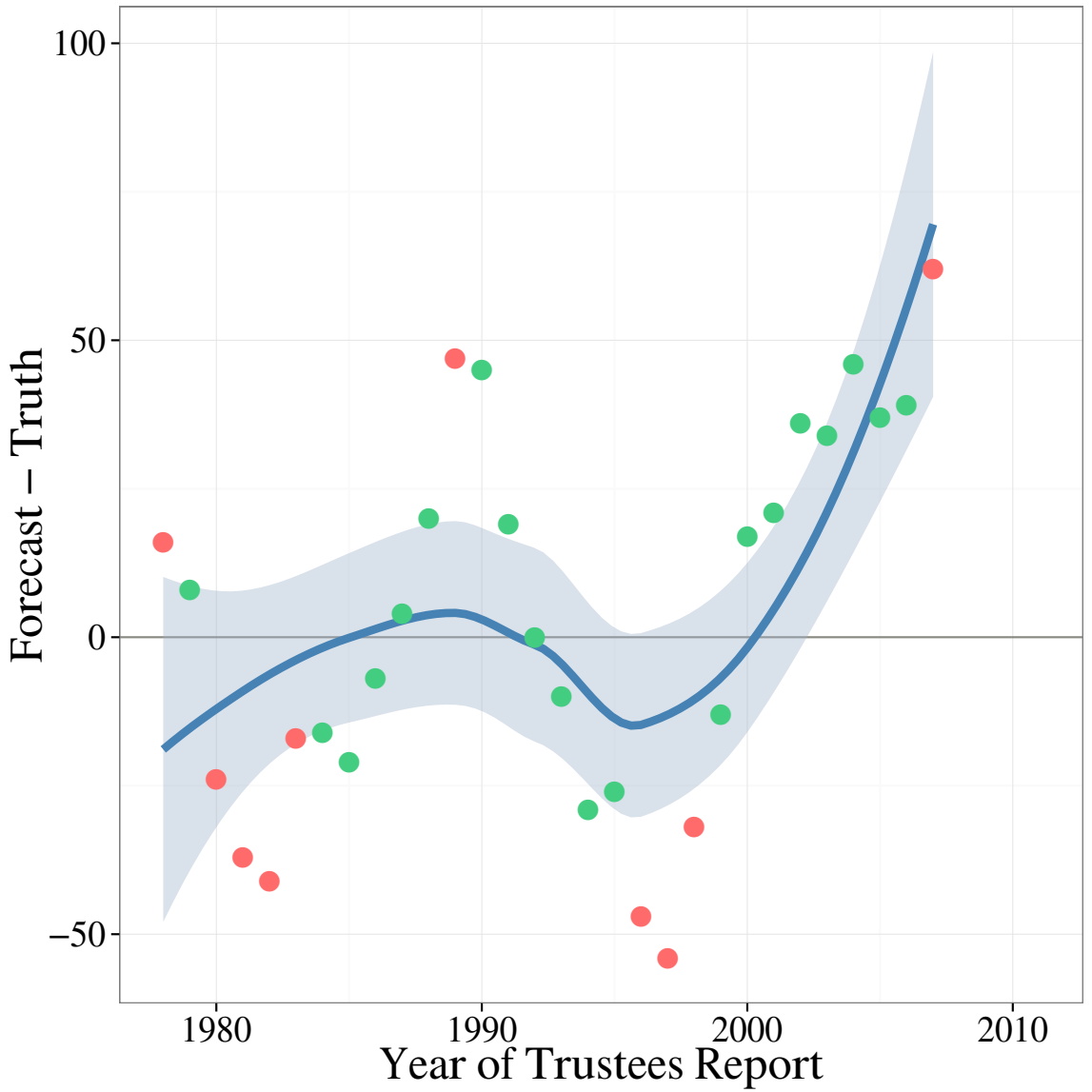
Trust Fund Ratio Forecasting Errors: 3 Years Ahead



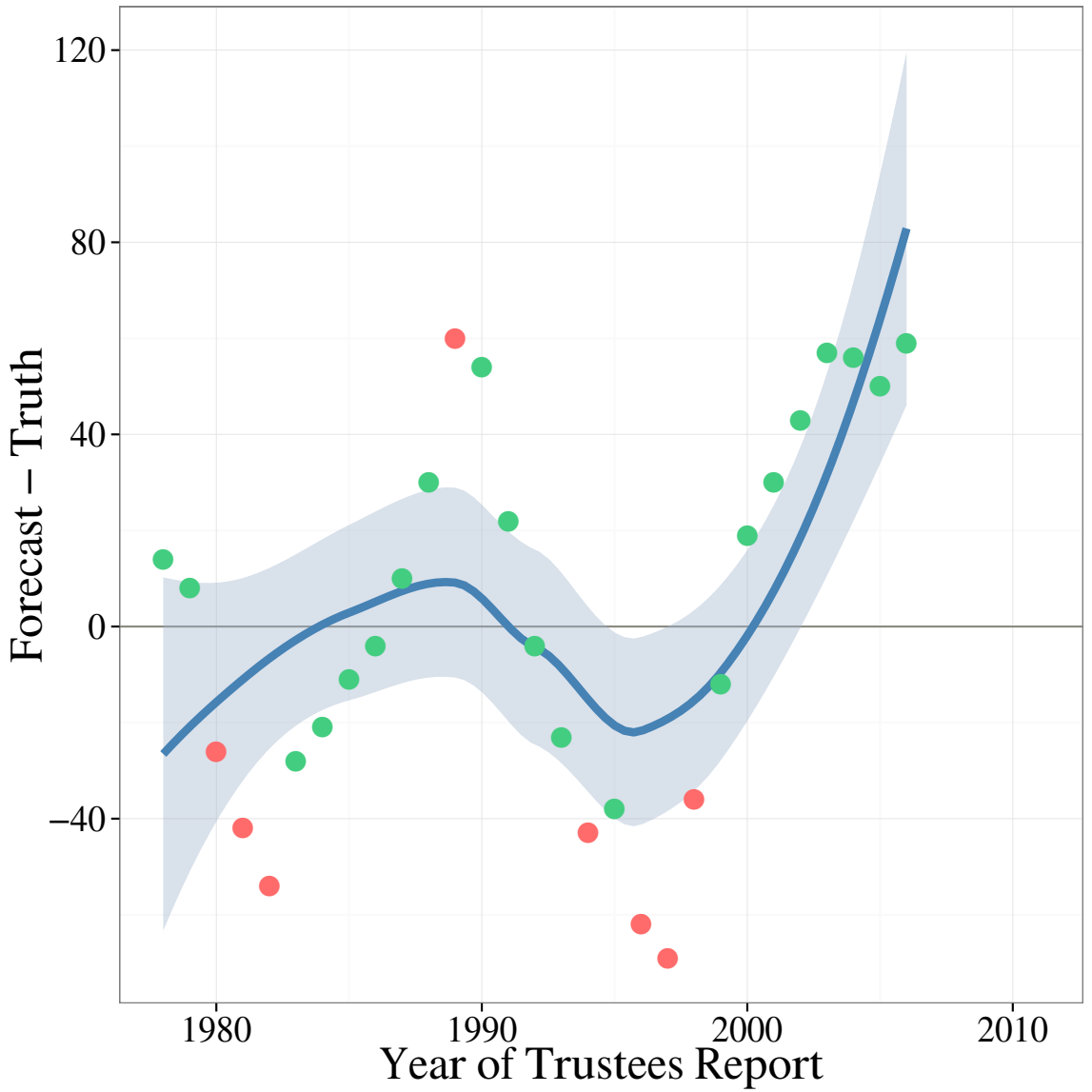
Trust Fund Ratio Forecasting Errors: 4 Years Ahead



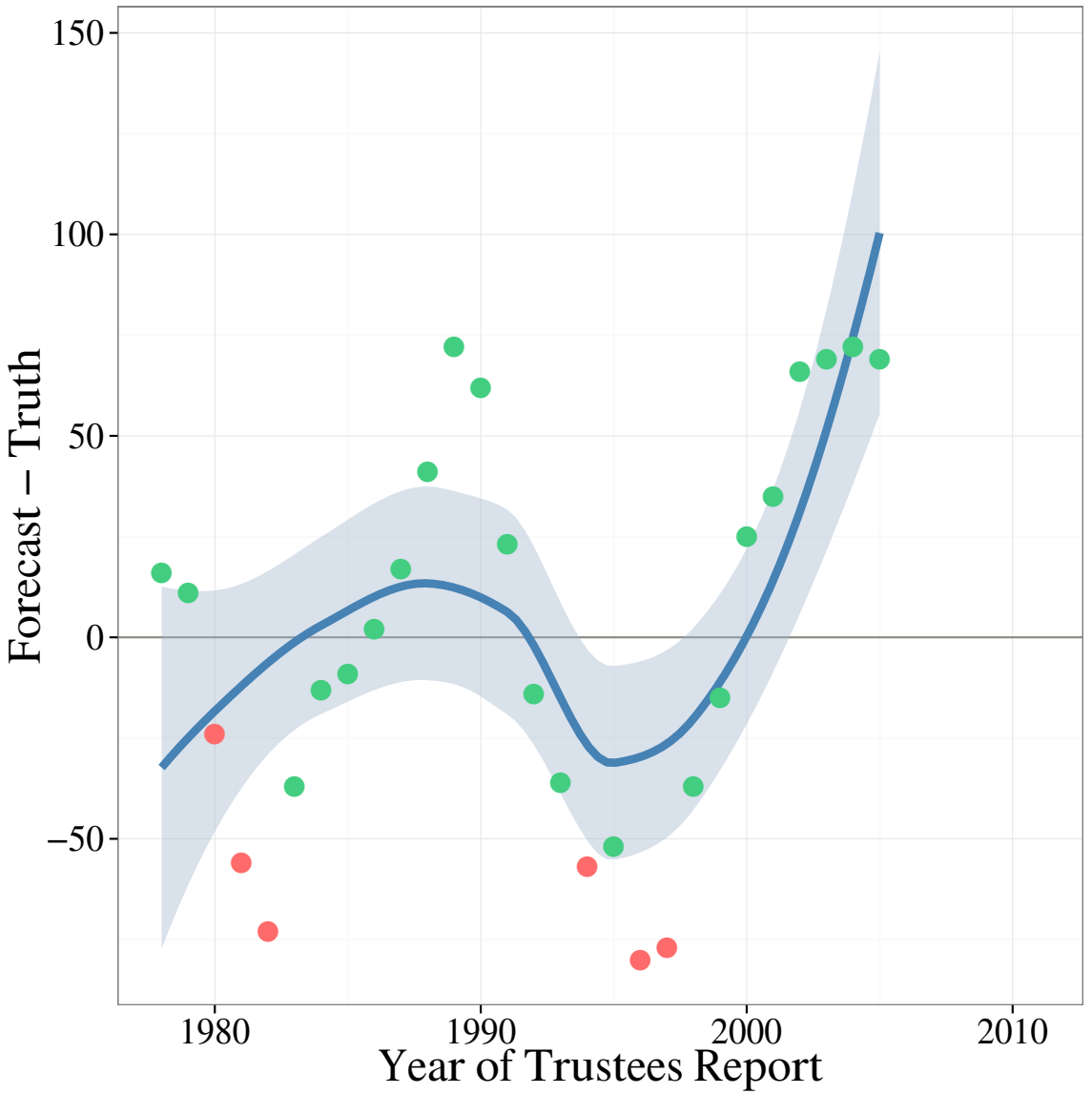
Trust Fund Ratio Forecasting Errors: 5 Years Ahead



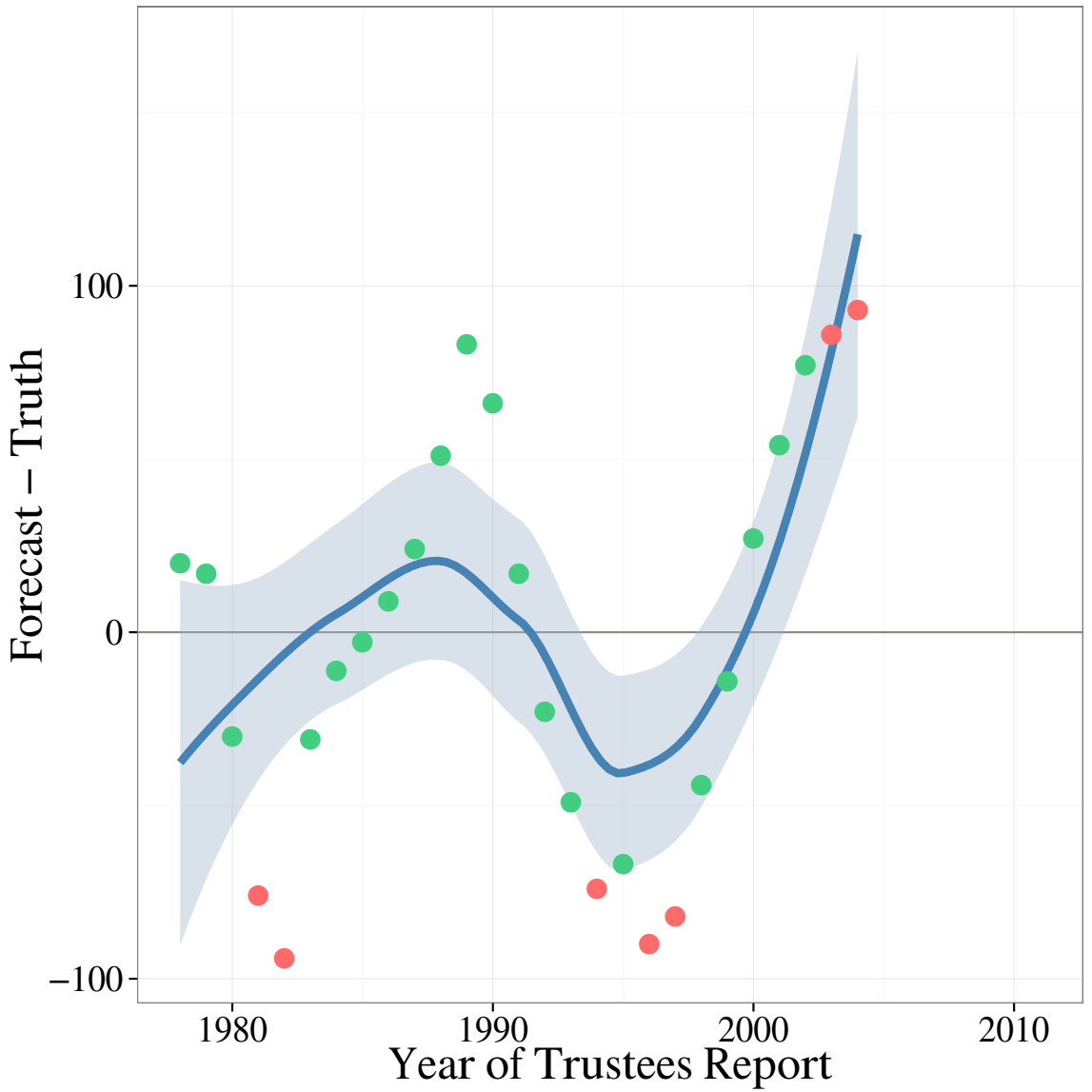
Trust Fund Ratio Forecasting Errors: 6 Years Ahead



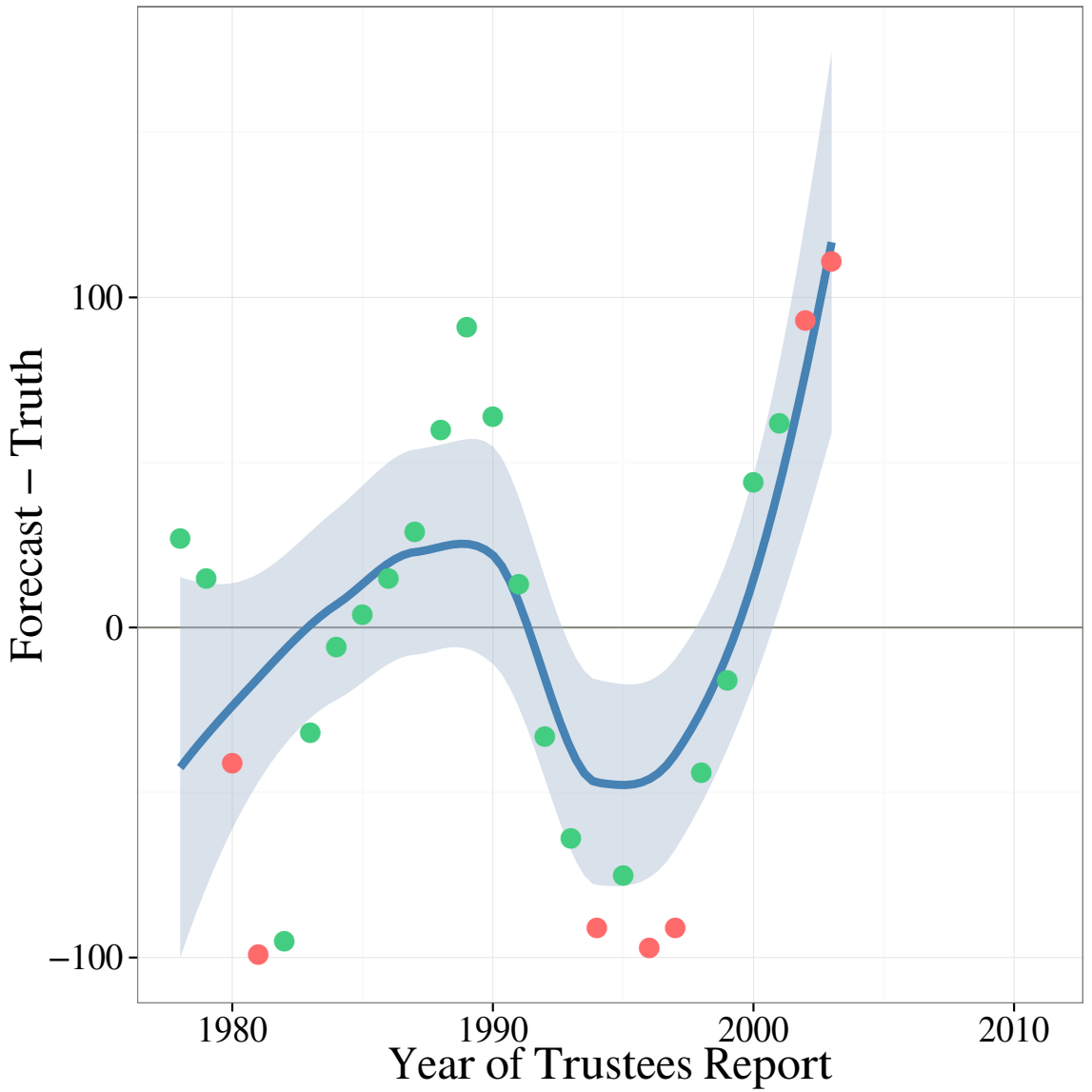
Trust Fund Ratio Forecasting Errors: 7 Years Ahead



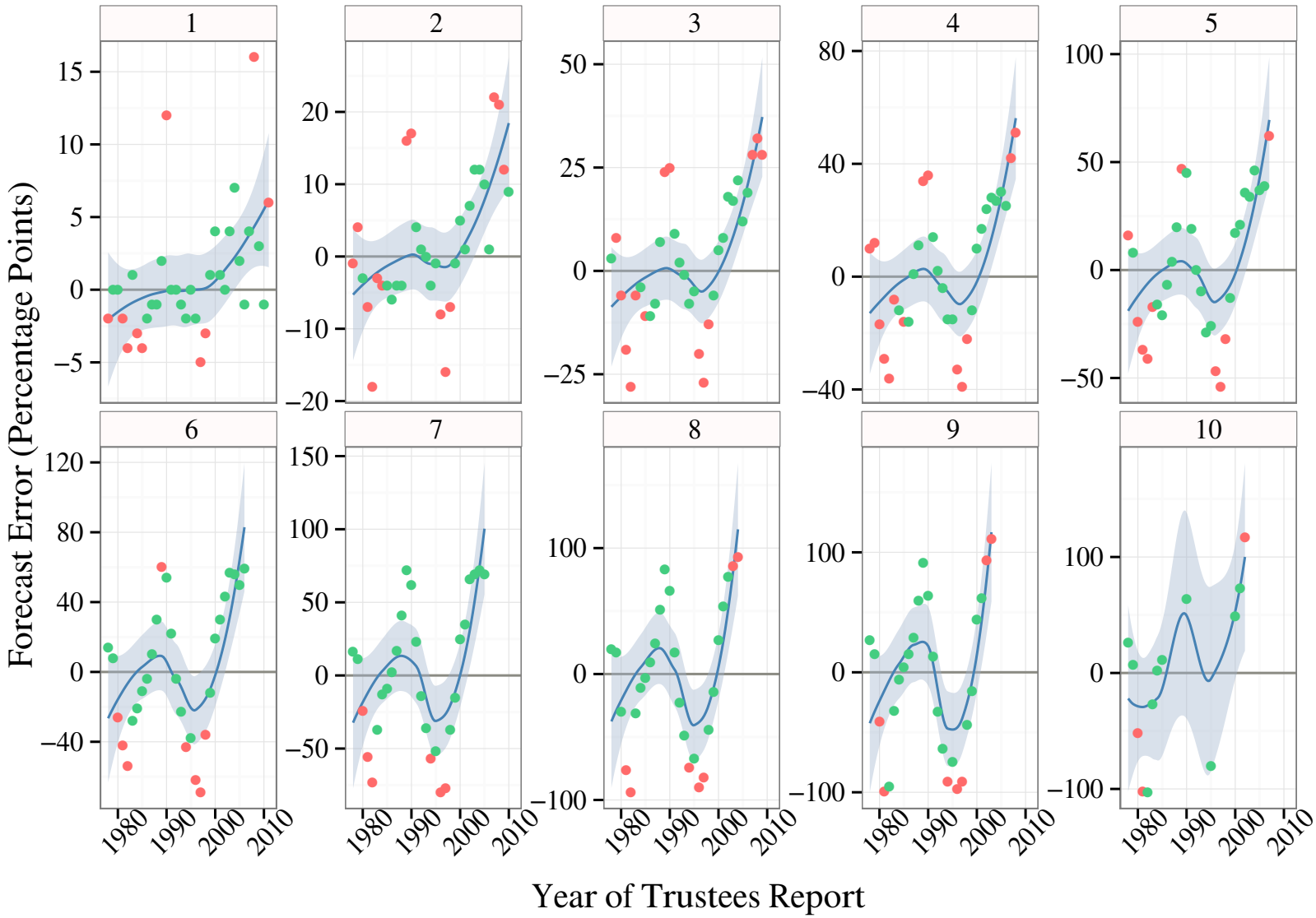
Trust Fund Ratio Forecasting Errors: 8 Years Ahead



Trust Fund Ratio Forecasting Errors: 9 Years Ahead



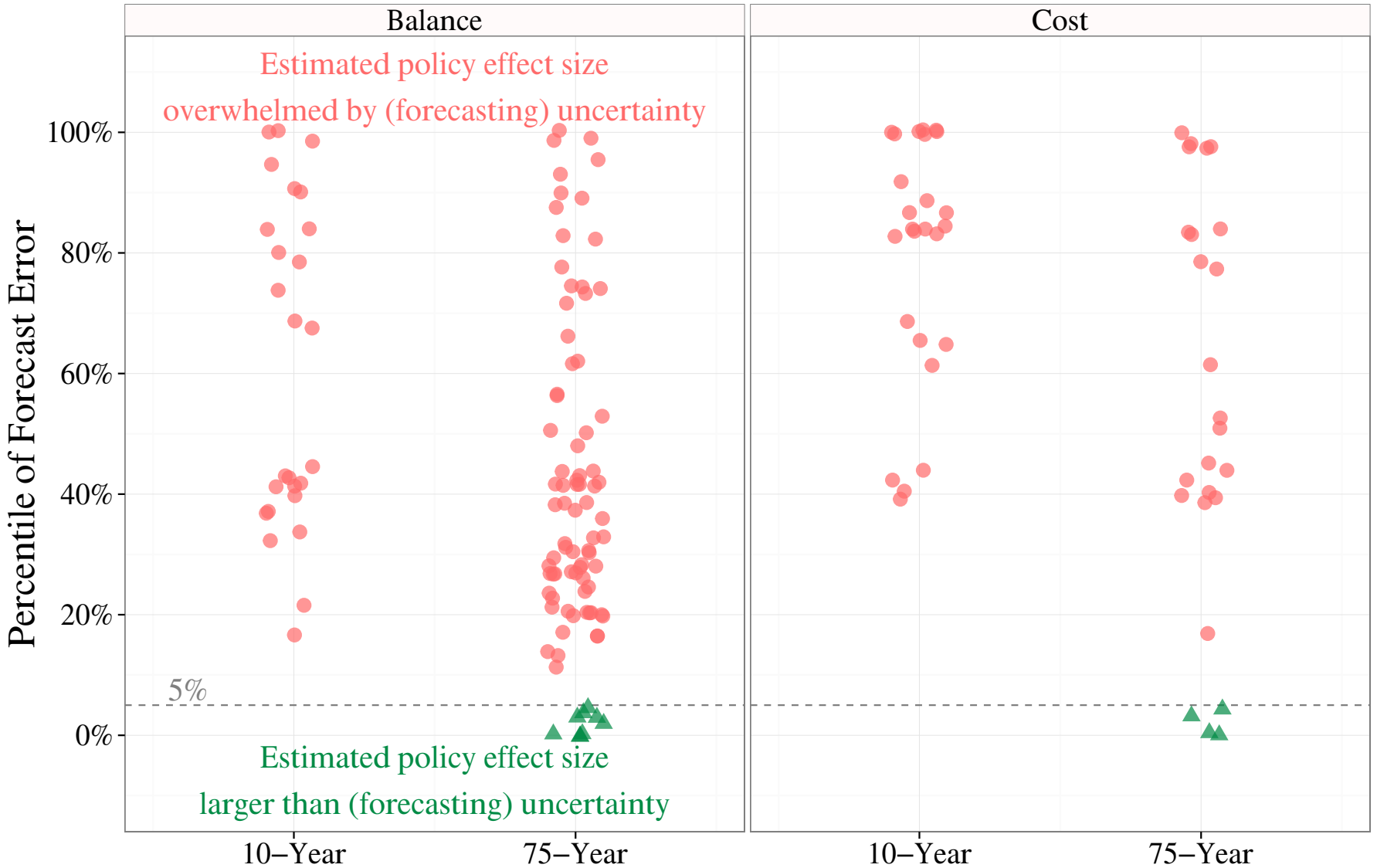
Trust Fund Ratio Forecasting Errors: Summary



Uncertainty Estimates for OCACT Policy Scores

- Who scores SSA Policy Proposals?
  - OCACT: the monopoly supplier for every major proposal (105 since 1993); lack of data sharing makes it impossible for others
  - Advantages: Both parties can negotiate to one point; being in OCACT is more exciting
  - Disadvantages: The one point the parties are negotiating to may be wrong; no one can check; hard to improve anything in isolation; the scientific community can't contribute
- OCACT's reported uncertainty estimates: none.
- Actual uncertainty: two components
  1. Forecasting under factual conditions
  2. Intervening under counterfactual conditions
- We estimate actual uncertainty: use 1st only (as a lower bound); compute percentile of error (among all forecast errors, 1-10 years out) where each score appears; how many are $> 95^{\text{th}}$ percentile i.e., with $\alpha \leq 0.05$? $\rightsquigarrow$ These are extremely optimistic assumptions

SSA Policy Scoring: Mostly Random Noise



Social Psychological Conditions that make Bias *Possible*

- "Bias": Systematic errors, regardless of intention or direction
- The soc-psych literature: Bias is likely when human beings perform complex tasks, with high discretion, many decisions, little feedback on whether they made the right choice the last time, high external pressure, in a group, and few external checks — exactly OCACT's situation & procedures
- Qualitative uncertainty estimates are also likely biased
  - "Experts" are usually overconfident.
  - "Do not trust anyone — including yourself — to tell you how much you should trust their judgment" (Kahneman 2011)
  - The more prominent or central a forecaster, the more overconfident their statements (Tetlock 2005) — and as the sole supplier of forecasts and policy evaluations, OCACT could hardly be more central
- It's not about the person: "Trying harder," or replacing one person with another, usually has no effect (Banaji and Greenwald 2013)
- It can't be learned: "Teaching psychology is mostly a waste of time" (Kahneman 2011)

A Three-Part Solution, from Three Revolutions

1. Remove human judgment where possible, via formal statistical methods — automate what can be automated
   - Evidence: The revolution in data science (big data, statistics, etc.)
   - Commercial models: Netflix Challenge, Kagle, TopCoder, Xprize
2. Institute formal structural procedures when human judgment is required — focus experts on what they're expert at
   - Evidence: The revolution in social psychology
   - Double-blind experiments, or peer review
   - Violin competitions behind a curtain, without shoes
3. Require transparency and data sharing to catch errors that slip through — bring the advantages of science to government
   - Evidence: The revolution in data sharing in academia and government, (and even to some extent industry)

Without Protections, Internal Pressures Make Bias Likely

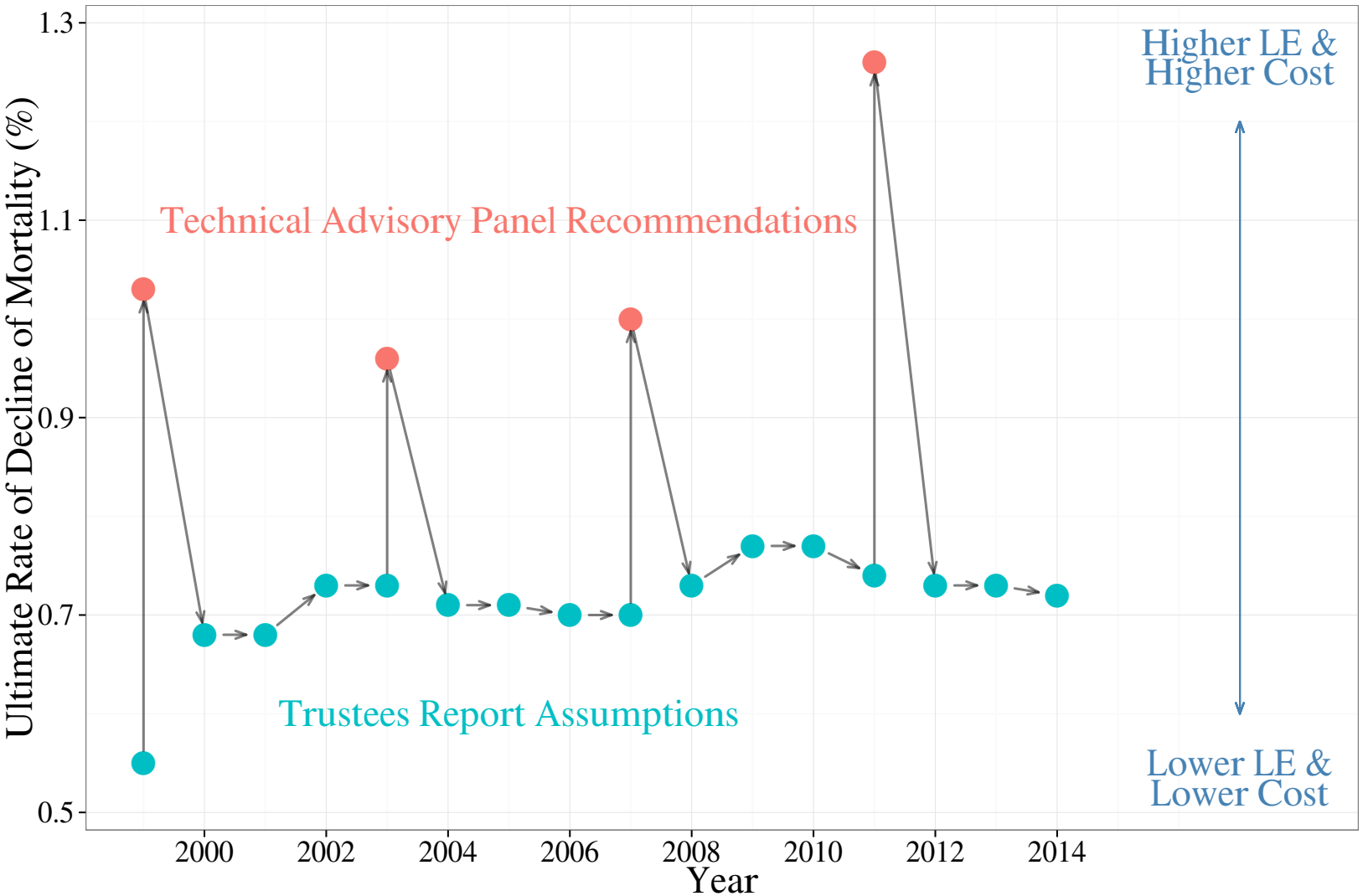
- OCACT's Stance as the Lone Island of Fairness
  - Many extreme statements: E.g., Steve Goss: "I'll take a bullet before I modify anything under any kind of political pressure"
  - We agree: no evidence of OCACT bending to political pressure
  - But OCACT acts as if it has a monopoly on fairness, letting no one else score proposals, make forecasts, or decide what's evaluated
  - Several said: "Goss is intellectually biased, not politically biased"
- Consistency Bias:
  - Degrading accuracy to maintain central role in policy debate
  - Intentionally biasing today's forecast towards yesterday's $\rightsquigarrow$ much smoother over time than related forecasts
  - When the Technical Panel recommends a change in a parameter:
    - If Goss has good evidence: he engages the Panel and convinces them
    - If the Panel has good evidence: he ignores the panel
    - If the Panel has very strong evidence: he adjusts the parameter part way, and adjusts another so the forecast is unchanged
  - Many quotes; e.g. Goss: "The hard part is trying to balance the need to change on the basis of new ideas and understanding with the desire for consistency and stability over time"

Ignoring Technical Panel Recommendations

- Process:
  - OCACT is extremely responsive in providing information
  - "Steve Goss has a seat at every table" when policy is made
- Technical Panel Methodological Recommendations
  - Little evidence of serious engagement: After each Panel, for the last 15 years: OCACT adopts a few recommendations, ignores many, and does not come close to the achievable ideal
  - Little progress on most important issues: Adopting formal statistical procedures, formal uncertainty estimates, transparency, data sharing, and routine systematic forecast evaluations
- Technical Panel Substantive Recommendations
  - For some: token dismissals in the Trustees Report
  - For others: the Trustees Report contradicts the Panel, repeats identically worded assertions year after year, without engaging the Panel or the crucial issues raised
  - The Trustees and Technical Panel agree on many issues too, but the lack of engagement or mutual understanding is obvious

Ignoring Technical Panel Recommendations

E.g., Ultimate Rates of (All-Cause) Mortality Decline Assumptions

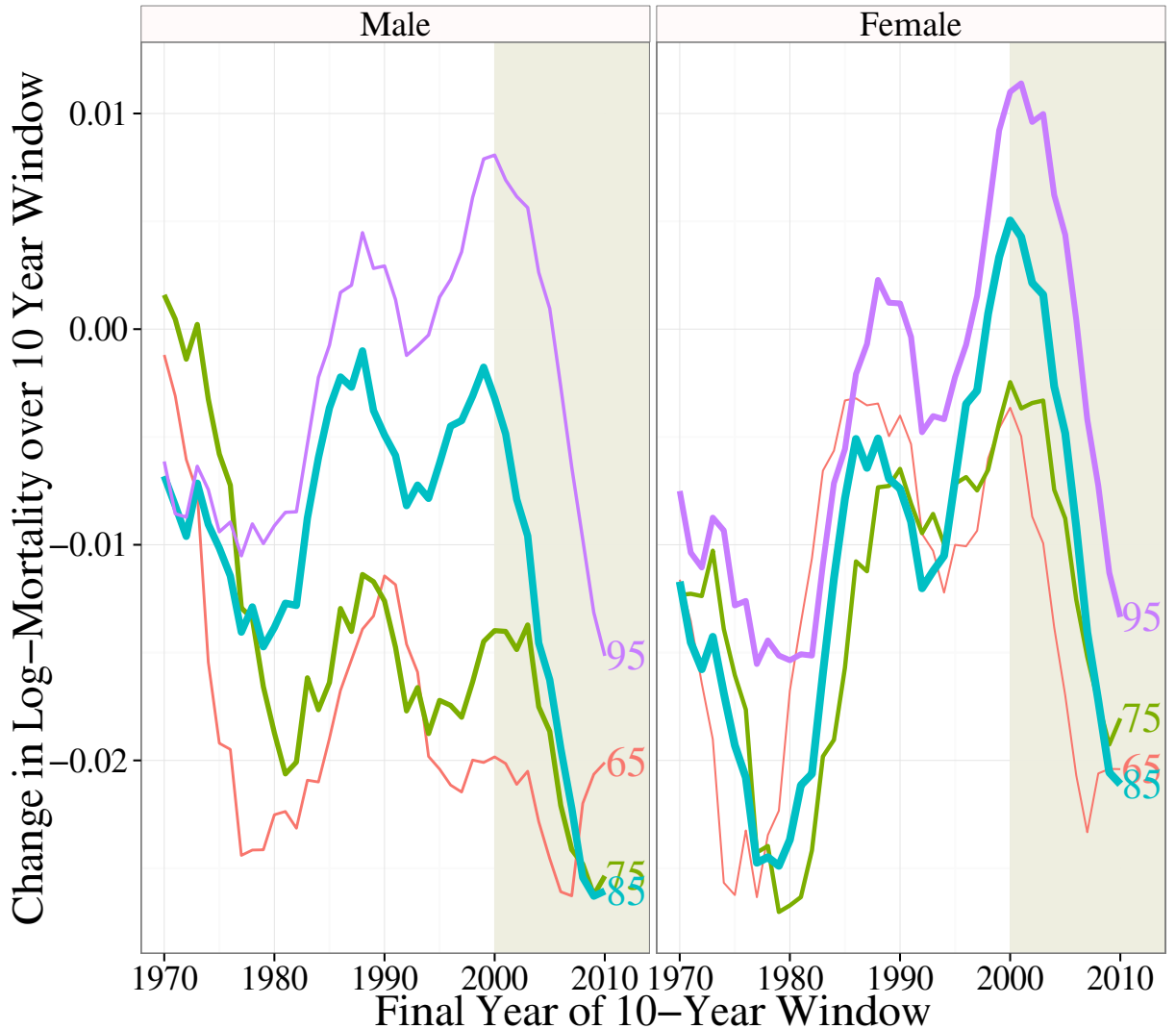


So what explains the bias?

- OCACT is vulnerable to bias, unprotected because they haven't:
  - Removed human judgment where possible
  - Instituted formal structural procedures, when judgment is required
  - Required transparency and data sharing
- Massively more intense & complicated politics than ever (details in our paper)
- Actuaries hunkered down, insulated themselves, refused to budge when Democrats & Republicans pushed hard for changes
- In the process, they also insulated themselves from the facts: Especially since 2000, Americans started living unexpectedly longer lives (due to statins, early cancer detection, etc.)

E.g.: Surprisingly Large Mortality Declines Since 2000

(Slopes from regression of log(mortality) on time from previous 10 years)



Conclusions

- The Problem
  - Informal forecasting methods $\rightsquigarrow$ the potential for bias
  - Civil servants working hard to resist intense pressure $\rightsquigarrow$ insulation from the data as well
  - Nontransparency, little data sharing $\rightsquigarrow$ no course corrections
  - Systematically & increasingly biased forecasts since 2000
  - Without better procedures, you or I could not do better
- The Solution: Professionalize
  - Remove human judgment where possible, via formal statistical methods — via the data science revolution
  - Institute formal structural procedures when human judgment is required — via the social psychological revolution
  - Require transparency and data sharing to catch errors that slip through — via the scientific revolution

---

For more information:

GaryKing.org